PROCEDURES, TREATMENT AND EQUIPMENT
INTENSIVE CARE UNIT (ICU)

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Patients in the Intensive Care Unit (ICU) often benefit from advanced forms of monitoring, procedures, and treatments. These can be complex and carry with them a small amount of risk. These procedures are not performed unless the benefit of doing them is felt to outweigh any risk.

Below you will find information about some of the treatments used in the ICU:

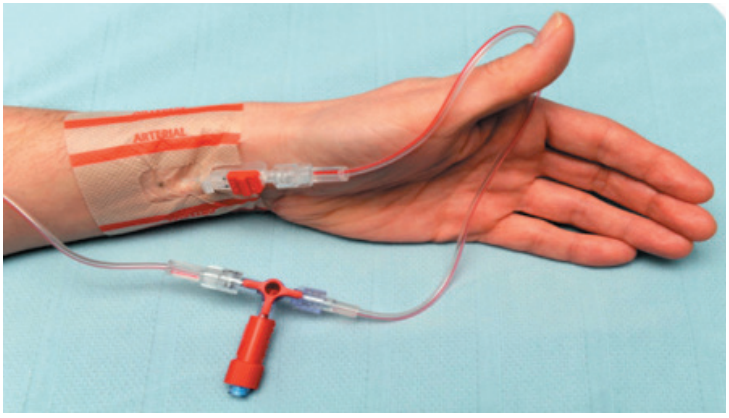
- **Arterial line (or art-line, A-line)**
- **Bronchoscopy**
- **Central line (or central venous line, CVC)**
- **Chest drains (or intercostal catheter, ICC)**
- **Dialysis (or continuous renal replacement therapy, CRRT)**
- **Echocardiogram**
- **Enteral feeding (or nasogastric feeding)**
- **Intubation (or endotracheal tube, ETT)**
- **Mechanical ventilation**
- **Non-invasive ventilation (or NIV, CPAP, BiPAP)**
- **PICC line (or peripherally inserted central line)**
- **Pulmonary artery catheter (PAC or Swann)**
- **Tracheostomy**
- **TPN (or total parenteral nutrition)**
- **Vascath (or dialysis catheter)**
- **Vasoactive medications (or inotropes)**

Of course, if you have any other questions at any time, please don't hesitate to talk to our nursing or medical staff.

ARTERIAL LINE (OR ART-LINE, A-LINE)

What is an arterial line?

An arterial line is a thin plastic tube which is inserted into an artery to continuously measure the blood pressure. It also allows blood samples to be drawn without the need to insert a needle through the skin each time.



Why is an arterial line needed?

Arterial lines are typically used in patients who are receiving treatment for very low or very high blood pressure, those having large operations, and those who need frequent blood tests. They are quite common in ICU patients.

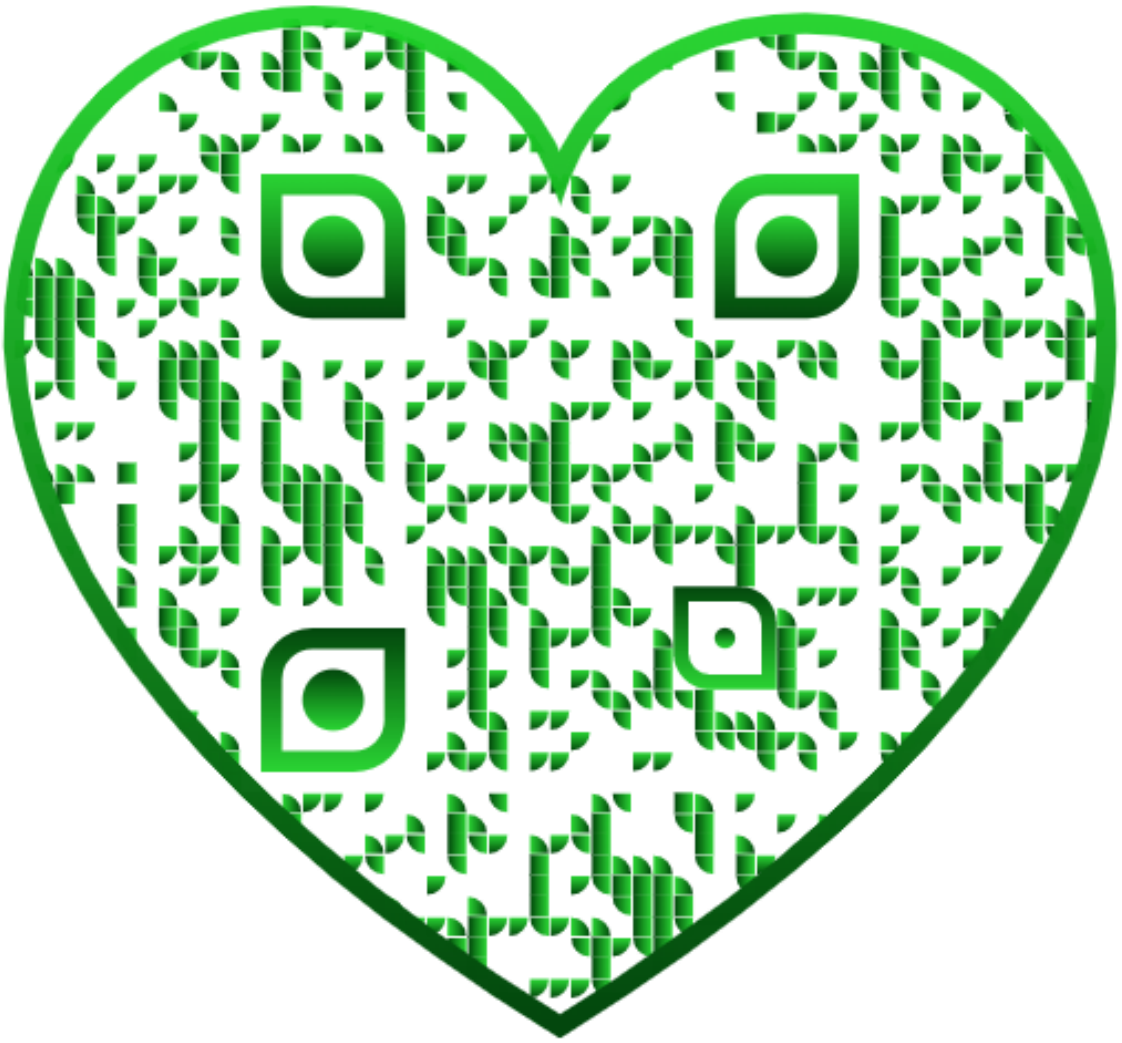
How is it put in?

Using local anaesthetic, and under very clean (sterile) conditions, a doctor inserts an arterial line using a needle passed into the artery. Often an ultrasound machine is used to guide the placement.

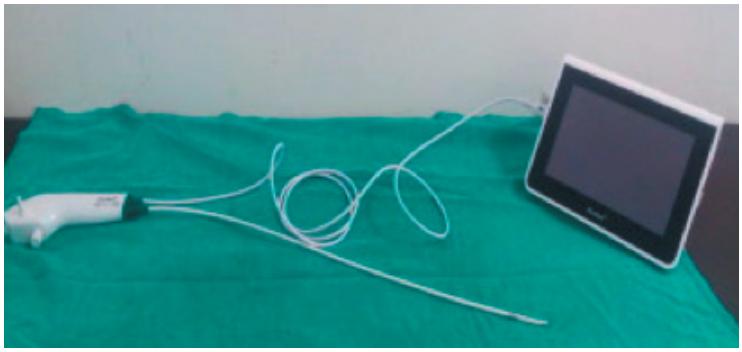
- It is secured in place with a stitch
- It is usually placed in the wrist, although sometimes in the elbow, groin or foot
- It can stay in for one to two weeks if necessary

Are there any risks?

Arterial lines are very safe. They may very occasionally cause injury to the artery, may cause infection or bleeding. The nursing staff constantly monitor for any complications.



BRONCHOSCOPY



What is bronchoscopy?

Bronchoscopy is a type of test where a small camera is inserted into the lungs.

Why is bronchoscopy needed?

Bronchoscopy is done to look at the inside lining of the windpipe, and also to remove sputum or blood clots from inside the lungs. It is also used to get samples of the fluid inside the lung to test for infection, or to take biopsies.

How is it put in?

It is often done when someone is attached to a breathing machine. The camera is passed into the lungs through the inside of the breathing tube, usually while the person is receiving an anaesthetic.

Are there any risks?

Bronchoscopy is very safe. There can sometimes be some bleeding, particularly if any biopsies are taken. There is a very small risk of a partial collapse of the lung, which will occasionally need to be treated with a chest drain (see "chest drain").

CENTRAL LINE (OR CVC)

What is a central line?

A central line is a long, thin plastic tube which is inserted into a large vein. It is used to measure the pressure in the veins of the body, and to safely deliver strong medications in very unwell patients. It also allows blood samples to be drawn without the need to insert a needle through the skin each time.

Why is a central line needed?

Central lines are typically used in patients who are receiving multiple medications at the same time, for those needing special types of medications such as those to treat a very low blood pressure or intravenous nutrition (see "vasoactive medications" and "TPN"), and those who need frequent blood tests.

How is it put in?

Using local anaesthetic, under very clean (sterile) conditions, a doctor inserts a central line using a needle placed into the vein. Often, an ultrasound machine is used to guide the placement.

- It is secured in place with a stitch
- It is usually placed in the neck, but can sometimes be in the groin
- It can stay in for several weeks if necessary

Are there any risks?

Central lines are very safe. They may very occasionally cause injury to other structures when they are being inserted, including arteries or the outside lining of the lung. They may become infected, and they can cause blood clots to form in the vein in which they are inserted. The nursing staff constantly monitor for any complications.

Chest drains (or intercostal catheters, ICCs)

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WHAT IS A CHEST DRAIN?

Chest drains are long tubes which are passed through the gap between two ribs or under the ribcage into the space around the lung. They are connected to a container which sits on the ground beside the patient's bed.

Why are chest drains needed?

Chest drains are used to allow fluid that has collected outside the lung to drain out of the body. They can also be used to allow air to escape from outside the lung if there is a small leak from the surface of the lung. They are always inserted during heart surgery, and usually during lung surgery. They are also sometimes inserted in the ICU for other patients.

How are they inserted?

Chest drains after heart or lung operations are inserted by the surgeon during the procedure. They are usually removed one to three days after the operation.

When a chest drain is inserted in ICU, it is done using local anaesthetic and a small cut in the skin on the side of the chest. A chest x-ray is performed to check that it is in the right position.

The drain is held in place with a stitch.

Are there any risks?

Chest drains are safe. They can occasionally cause bleeding, infection, or can injure the lung when they are inserted. Very occasionally when inserted in the ICU, they can be positioned in the wrong place and may need to be re-inserted.

DIALYSIS (CONTINUOUS RENAL REPLACEMENT THERAPY, CRRT)

What is dialysis?

Dialysis is a type of treatment to replace the function of the kidneys when they are not working properly.

Why is dialysis needed?

The kidneys often stop working when people are critically ill. When the kidneys don't work, toxins can build up in the blood stream and can cause people to become even more sick. In most patients, the kidneys will eventually recover and the dialysis can be stopped, although there are a very small number of people who need to stay on dialysis, even after they have left hospital.

How is it performed?

A small tube (called a vascath) is inserted into a large vein in the body (see "vascath"). This tube is used to draw blood out of the body and pass it through a dialysis machine, which washes the blood and returns it to the patient.

Are there any risks?

Dialysis is a very safe process, with minimal complications. Occasionally, dialysis can cause the blood pressure to fall. The blood can also clot within the dialysis machine, meaning it can't be returned to the patient. This may mean a patient needs a blood transfusion.

There can be some complications related to the tube which draws the blood into the machine (see "vascath").

Nursing staff frequently monitor a patient on dialysis for complications.

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ECHOCARDIOGRAM (OR "ECHO")

What is an echocardiogram?

An echocardiogram is an ultrasound of the heart.

There are two types of echocardiogram:"transthoracic" where the ultrasound probe is place on the person's chest (similar to an ultrasound during pregnancy), and "transoesophageal" where the ultrasound probe is passed through the mouth into the oesophagus (the food pipe).

Why is an echocardiogram needed?

Patients in the ICU can have changes to the way the heart beats, particularly after surgery on the heart. The echocardiogram helps us to know what sort of treatments a person may need to make the heart pump most effectively.

How is it done?

A transthoracic echocardiogram is performed using a probe placed on the chest.

A transoesophageal echocardiogram is performed using a probe at the end of a long wire which is passed down the throat into the food pipe. By doing this, the ultrasound pictures are clearer, particularly after surgery on the heart.

Are there any risks?

Transthoracic echocardiograms are extremely safe.

Transoesophageal echocardiograms have a small risk due to passing the probe down the throat and into the food pipe. There is a very small risk of damage to the food pipe which, in extremely rare circumstances, can be very serious.

The decision on which type of echocardiogram to perform is based on many things, including the reason the test is needed.

Enteral nutrition (or nasogastric feeds)

ENTERAL NUTRITION (OR NASOGASTRIC FEEDS)

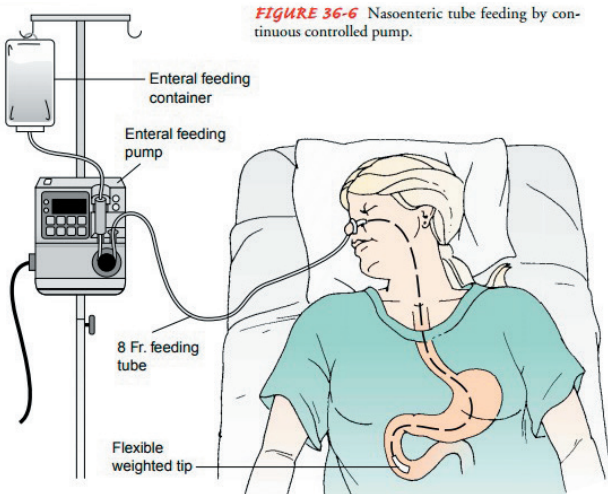

FIGURE 36-6 Nasoenteric tube feeding by continuous controlled pump.

What is enteral nutrition?

Enteral nutrition really just means food that is passed through the digestive tract. In the ICU, it is usually used to refer to food that is passed into the stomach through a fine tube which is inserted in the nose, and down into the stomach (a nasogastric tube).

Why is enteral nutrition needed?

Enteral nutrition is used to give food to those patients in ICU are unable to eat (either because they are not awake enough, can't swallow or have no appetite). It is okay not to eat for a few days, however it can eventually cause problems such as loss of weight, low protein levels, and a worse recovery from illness.

Our speech therapists and nurses carefully monitor whether patients can safely swallow food.

How is it put in?

A nasogastric tube is inserted through the nose, either in an awake patient (in which case they can help by swallowing the tube) or in a patient who is unconscious. It is passed down into the stomach, and an x-ray is taken to check that it is in the right place.

Are there any risks?

Nasogastric tubes can be uncomfortable, particularly when they are first put in. They can sometimes be accidentally placed into the lungs, and so an x-ray is taken to check the position before any food is given.

Occasionally, patients can get a sore at the edge of the nostril from the tube.

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INTUBATION (OR ENDOTRACHEAL TUBE, ETT)

What is intubation?

Intubation is the process of inserting a breathing tube (endotracheal tube, or ETT) into the lungs via the mouth. This breathing tube can then be connected to a breathing machine (ventilator) to assist a person to breath.

Why is intubation needed?

Intubation is required when a person is having trouble breathing and needs to be attached to a breathing machine. It is also used when a person is unconscious and unable to cough or breathe for themselves. It is often used during an anaesthetic for a major operation, and the tube can be left in the mouth for a period of time after the operation.

How is it done?

Intubation is typically done after a patient is given an anaesthetic and is unconscious. A doctor inserts the breathing tube into the mouth, and passes it through the voice box into the lungs. This is sometimes done as an emergency life-saving procedure, and sometimes it is planned.

Are there any risks?

Intubation is a very important procedure and has to be done very carefully. The most important risk is that it can be impossible to get the breathing tube into the lungs, which can lead to death. Fortunately, this is exceedingly rare.

More common risks include damage to the teeth or to the voice box, or allergic reactions to the medications used for the anaesthetic. Doctors who perform this procedure receive a lot of special training in order to do it safely.

MECHANICAL VENTILATION (OR VENTILATION)

What is mechanical ventilation?

Mechanical ventilation is when a breathing machine helps someone to breathe by pushing air into and out of the lungs via a breathing tube.

The breathing tube can either pass into the lungs through the mouth (see “intubation”) or can be inserted directly into the windpipe through the front of the neck (see “tracheostomy”).

Why is mechanical ventilation needed?

It is used to help patients who are finding it hard to breathe, when oxygen levels are low, or when a person is unconscious. It is also used as part of an anaesthetic, and will often be continued for a period of time after an operation.

How does it work?

The breathing machine pushes air into and out of the lungs. It can do all of the work of breathing, or it can assist a person who is doing some of the breathing themselves.

Are there any risks?

There are a number of risks, such as pneumonia and other forms of injury to the lungs or voice box. Also, because people attached to a ventilator are usually given sedation and are not moving much, they can lose muscle strength. For this reason, mechanical ventilation is usually reserved for people who are either very sick, or who are having large operations. We frequently assess patients attached to a breathing machine to see when they can start breathing by themselves.

There are also some complications which can occur during the insertion of the breathing tube (see “intubation” and “tracheostomy” for more information).

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NON-INVASIVE VENTILATION (OR NIV, CPAP, BIPAP)

What is non-invasive ventilation?

Non-invasive ventilation is a way of helping a person breath by pushing air into the lungs via a tight-fitting mask. CPAP and BiPAP are two different types of non-invasive ventilation.

The mask used can either cover the nose, the nose and the mouth, or the entire face.

Why is non-invasive ventilation needed?

It is used to help patients who are finding it hard to breathe, when oxygen levels are low, when there is too much fluid in a person's lungs, and when a person has obstructive sleep apnoea. The mode that is used will depend on the reason it is being used. The type of mask used depends on a patient's preference.

How does it work?

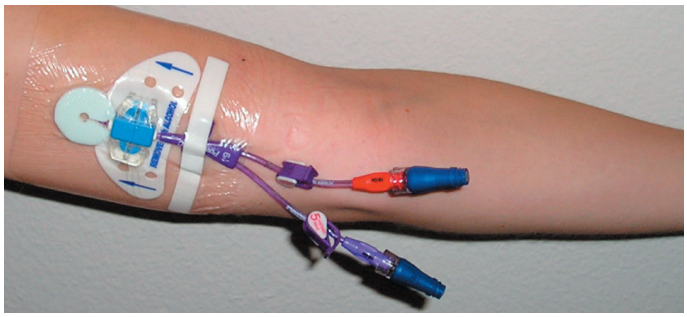
The mask is held tightly to the face with straps. The mask is attached to a small breathing machine which pushes air into the lungs. Extra oxygen can also be added.

Are there any risks?

The main problem with non-invasive ventilation is that some people find it uncomfortable. It can also cause vomiting, and if worn for a long time can cause marks or injury to the skin around the face and nose.

For some people, more support is needed, and a breathing tube might need to be inserted.

PICC LINE (PERIPHERALLY INSERTED CENTRAL LINE)



What is a PICC line?

A PICC line is a very long, thin plastic tube which is inserted into a vein in the arm and passed through to the larger veins near the heart.

Why is a PICC line needed?

It is used to give special types of medications such as those to treat a very low blood pressure or intravenous nutrition (see "vasoactive medications" and "TPN"). Because it can remain in place for many weeks, it can reduce the number of needles someone might need. It also allows blood samples to be drawn without the need to insert a needle through the skin each time.

How is it put in?

Using local anaesthetic, under very clean (sterile) conditions, a doctor inserts a PICC line using a needle placed into the vein. Often, an ultrasound machine is used to guide the placement. PICC lines can be inserted in ICU or in the radiology department.

- It is secured in place with a special dressing
- It is usually placed in the front of the elbow
- It can stay in for many weeks if necessary

Are there any risks?

PICC lines are very safe. They may become infected, and can cause blood clots to form in the vein in which they are inserted. The nursing staff constantly monitor for any complications.

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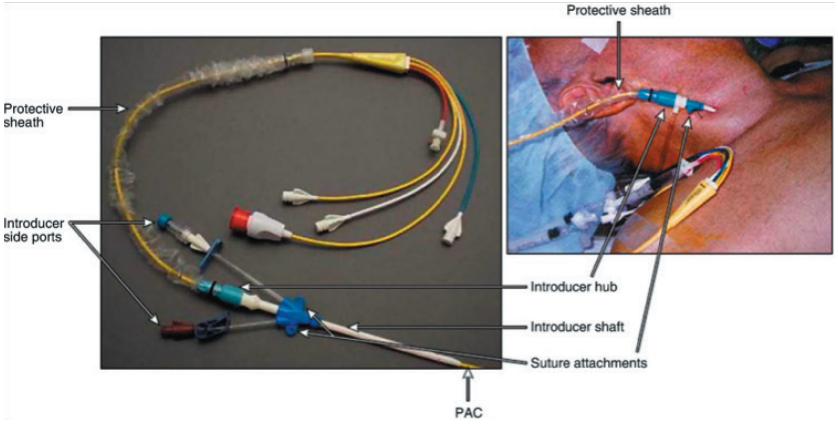
PULMONARY ARTERY CATHETER (OR PAC, SWANN)



What is a pulmonary artery catheter?

A pulmonary artery catheter is a very long, thin plastic tube which is inserted into a vein in the neck and passed through the heart and into the lungs.

Why is a pulmonary artery catheter needed?

It is used to measure the pressure inside the blood vessels of the lungs, and also to measure how well the heart is pumping. It is most commonly used during and shortly after surgery on the heart.

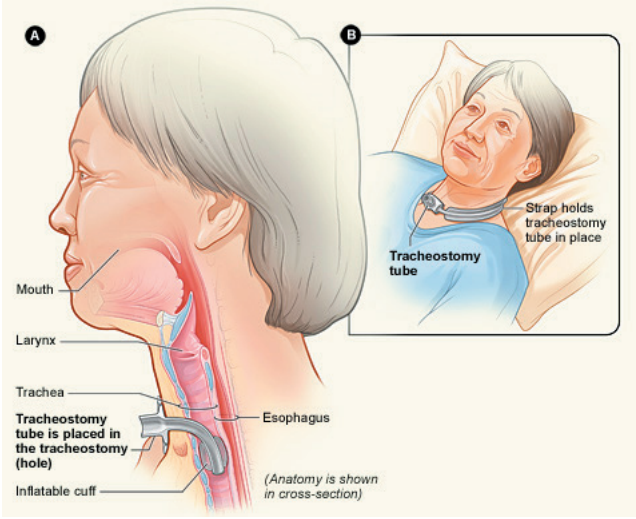
How is it put in?

Pulmonary artery catheters are almost always inserted when a person is under an anaesthetic, in the operating room as part of their heart operation. It remains in place for the first day or so after the operation. The anaesthetist inserts the catheter using a small needle inserted into a vein in the neck, under very clean (sterile) conditions.

Are there any risks?

Pulmonary artery catheters are safe. They can cause the heart to beat irregularly when they are inserted, and can extremely rarely damage the blood vessels in the lungs. The nursing staff constantly monitor for any complications.

TRACHEOSTOMY



What is a tracheostomy?

A tracheostomy is a type of breathing tube which is inserted into the windpipe at the front of the neck, into the lungs.

Why is tracheostomy needed?

After many days of having a breathing tube in the mouth, we sometimes consider changing to a tracheostomy. By taking the tube out of the mouth and inserting it directly into the windpipe, it is more comfortable for the patient and allows us to slowly remove the breathing machine. It also allows the patient to get help with their breathing without needing to be kept sedated.

How is it put in?

Tracheostomy tubes are usually inserted in the ICU, although occasionally they need to be done in the operating theatres. The patient is given an anaesthetic, and a small operation is performed to place the tube through a cut in the front of the neck. After the tracheostomy is inserted, the breathing tube in the mouth is removed.

Are there any risks?

The most serious risk of tracheostomy is a loss of control over the person's breathing during the insertion procedure. This is potentially life-threatening, but is fortunately exceedingly rare.

Other risks include bleeding, damage to the windpipe and infection at the skin where it is inserted. Very occasionally, these complications require further surgery to be fixed.

When a tracheostomy is removed, it leaves a very small scar on the front of the neck.

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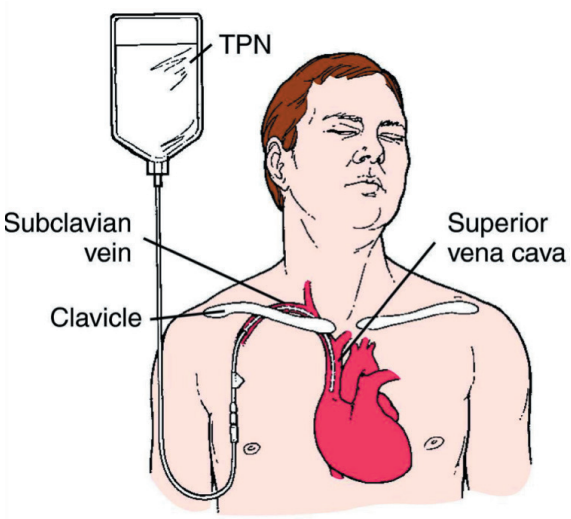
TPN (OR TOTAL PARENTERAL NUTRITION)



What is TPN?

TPN is a specialised type of intravenous feeding that is given directly into the bloodstream through a central line or a PICC line (see "central line" and "PICC line". It contains a carefully balanced mix of protein, calories, vitamins and nutrients.

Why is TPN needed?

TPN is used when it is not possible to give a patient food through the stomach. This may be because their stomach or other part of the gut is not working, or because they have had surgery on part of the gut. It is reserved for when it is not possible to give food for many days.

How is it administered?

TPN can only be given through a central line (see "central line") or a PICC line (see "PICC line"). It is given as a continuous drip.

Are there any risks?

TPN can increase the risk of infections, can cause a high blood sugar, and can lead to abnormal levels of salts in the bloodstream.

Nursing staff and dieticians are carefully monitor for any of these complications.

VASCATH (OR DIALYSIS CATHETER)

What is a vascath?

A vascath is a long, thin plastic tube which is inserted into a large vein. It can then be attached to a dialysis machine.

Why is a vascath needed?

Vascaths allow blood to be removed from the person's body, and also to be returned to the body after it has passed through a dialysis machine.

How is it put in?

Using local anaesthetic, under very clean (sterile) conditions, a doctor inserts a vascath using a needle placed into the vein. Often, an ultrasound machine is used to guide the placement.

- It is secured in place with a stitch
- It is usually placed in the neck or the groin
- It can stay in for several weeks if necessary

Are there any risks?

Vascaths are safe. They may very occasionally cause injury to other structures when they are being inserted, including arteries or the outside lining of the lung. They may become infected, and can cause blood clots to form in the vein in which they are inserted.

The nursing staff constantly monitor for any complications.

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VASOACTIVE MEDICATIONS (OR VASOPRESSORS, INOTROPES)

What are vasoactive medications?

Vasoactive medications are medications which are used to stabilise the heart function and the blood pressure. These medications are very commonly used for ICU patients, but rarely used outside of the ICU.

Why are vasoactive medications needed?

Very high or very low blood pressure is common in patients in ICU. Also, many patients in ICU will have variations of the strength of their heartbeat. This can happen due to severe infections, after heart surgery or other major operations, and for many other reasons.

Having a normal blood pressure and heartbeat is very important to make sure blood (and oxygen) is flowing around the body effectively.

How do they work?

Some of these medications stimulate the heart to beat faster or stronger, some cause blood vessels to dilate or constrict, and some of them do both.

Are there any risks?

The main problem with these medications is that the dose needs to be constantly monitored and altered by the nursing staff. In order to do that, patients need to have their heartbeat and blood pressure closely monitored, often using an arterial line (see “arterial line”). Also, unless used in very low doses, these medications need to be given through a central line (see “central line”) or PICC line (see “PICC line”).